

PATENT ABSTRACTS OF JAPAN

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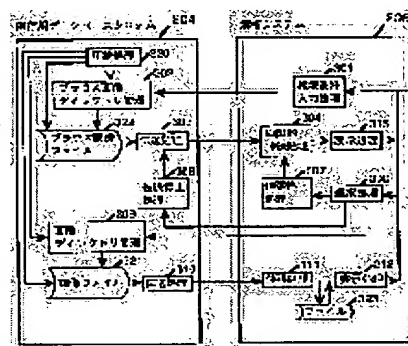
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SETO YOICHI

(54) PICTURE DATA RETRIEVAL METHOD

(57)Abstract:

PURPOSE: To reduce the transmission of unnecessary picture data and to shorten retrieval time by executing the expanding stop processing and the transmission stop processing of unnecessary picture data retrieved in the middle of an expanding processing by means of progressive encoding.
CONSTITUTION: In a data base system for preservation 204, a picture and a browsing picture as auxiliary information of a picture retrieval are compression-processed 320, and they are accumulated in a picture file 321 and a browsing picture file 322. In a transmission processing 303, the browsing picture becoming a candidate by a browsing picture directory management 302 is transmitted to an analysis system 206. When the target picture is visually recognized from the display picture and the picture is selected by click input using a mouse 326 in a selection processing 308 while a stepwise expanding processing 304 by progressive encoding is executed, the stepwise expanding of the browsing picture is stopped by an expanding stop processing 307. The stepwise transmission of the browsing picture is stopped by a transmission stop processing 308 and the picture is retrieved from the selected browsing picture.



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[Date of final disposal for application]
[Patent number]
[Date of registration]
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CLAIMS

[Claim(s)]

[Claim 1] The image file which accumulates the compressed image, and the retrieval processing which searches an image from said image file, In the image data retrieval processing which consists of a display process which displays an elongation image as the gradual elongation processing which elongates the compression image of high resolution one by one from the transmission processing which carries out sequential transmission of the compression image of high resolution from the image of a low resolution, and the image of a low resolution The selection processing which chooses the image of arbitration from two or more display images, and the elongation halt processing which suspends said gradual elongation processing, The image data retrieval approach of carrying out containing the transmission halt processing which suspends gradual transmission processing, the elongation rerun processing which cancels an elongation halt and reruns said gradual elongation processing, and the transmission rerun processing which cancels a transmission halt and reruns transmission processing as the description.

[Claim 2] Said selection processing of claim 1 is the image data retrieval approach with the function which indicates the image chosen to two or more images on display by retrieval.

[Claim 3] Said elongation halt processing and said transmission halt processing of claim 1 are the image data retrieval approach using interrupt processing which interrupts said gradual elongation processing under activation, and said transmission processing under activation, and stops gradual elongation and transmission.

[Claim 4] Said elongation rerun processing of claim 1 and said transmission rerun processing are the image data retrieval approach using interruption discharge processing in which cancel interruption to said gradual elongation processing and said transmission processing under halt, and gradual elongation and transmission are made to rerun.

[Claim 5] The image data retrieval approach of having the function which can carry out regeneration of the function which stops the function or the unnecessary image which can perform the display of the function which displays two or more images and can perform the display of a detail image in the middle of image display in claim 1, or the following candidate image, or the stopped image.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the image data retrieval approach of displaying especially a candidate image on a screen and searching the target image at a high speed, with respect to retrieval processing of the medical image accumulated in a database, a satellite image, a goods catalog, etc. of mass image data.

[0002]

[Description of the Prior Art] In the database system which manages images, such as a medical image and a goods catalog, the centralized control of the data is carried out in the center, and a user's method which searches data through a network is common. In case data are searched, in order to choose the target data, two or more browsing (outline) images are indicated by transfer at a high speed, and the judgment by viewing is effective.

[0003] Even if it calls it a browsing image, since there is much amount of data, it needs to mitigate a network transmission load on the occasion of retrieval. As an approach of mitigating a transmission load, the compression elongation approaches, such as JPEG (Joint Photographic Experts Group) of a publication, are effective in "the international standards of multimedia coding" (the Yasuda *****, the June 30, 1991 issue, and Maruzen Co., Ltd.) standardized in ISO (International Organization for Standardization) and CCITT (Consulting Committee of International Telegraph & Telephone). In 1 second, the data transmission of N-ISDN (service synthesis digital network) is 64k bits in transmission speed, and takes 384 seconds for transmitting each length, 1024 pixels wide around, red, green, blue, and a 8-bit image. By compressing and transmitting image data to one half, a transmission time can be shortened at 192 seconds of one half, and is effective in improvement in the speed of transmission.

[0004] There are a standard compression elongation approach which displays by creating and transmitting one compressed data to one image data in compression elongation processing, and elongating compressed data, and the gradual compression elongation approach which separates and compresses image data into two or more resolution, transmits image data for the image of high resolution with much amount of data one by one from the image of a low resolution with little amount of data, and repeats elongation and a display.

[0005] The gradual compression elongation approach can check the contents of an image at the time of the low resolution picture display in early stages of transmission. For this reason, the gradual compression elongation approach is effective in retrieval processing of a browsing image. The progressive coding approach of JPEG description is in reference as an example of the gradual compression elongation approach.

[0006] According to the reference, progressive coding is SAKUSESHIBU, APUROKISHIMESHON (it is called a Successive Approximation method and a following SA method) and SUPEKUTORARU There are selection (it is called a Spectral Selection method and following SS) and a hierarchie cull method. For example, SA method is the approach of dividing a compression image for every bit from a high order bit to a lower bit, and encoding.

[0007] The compression processing by SA method consists of sequence conversion which deletes the redundant data of an image, entropy code modulation which performs coding, and a bit slice which divides data for every bit. Sequence conversion consists of discrete cosine transform (DCT) processing and quantization processing. DCT processing is performed in an image, an image is changed into spatial frequency, and compressibility is raised by quantization processing. A bit slice is used in order to create a gradual image.

[0008] The example is shown in drawing 3. DCT processing and quantization processing are performed to the image 101 of 8 bits of pixels, and the DCT multiplier 102 is obtained. n data eye which expressed the m-th bit of the obtained DCT multiplier 102 with bm, and divided it is called the n-th plane. When the DCT multiplier 102 is 8 bits, b7, b6, b5, and b4 bit are divided as the first plane 111 from a high order bit. Hereafter, the second plane 112 and b2 are divided for b3, and the fourth plane 114 and b0 are divided for the third plane 113 and b1 as the fifth plane 115. Each divided plane is encoded by entropy-code-modulation processing. Entropy-code-modulation processing deletes the redundant data of an image using Huffman coding.

[0009] Elongation processing is performed by repeating each processing of the decryption and bit connecting which consist of reverse processings of compression processing, reverse quantization, and inverse cosine conversion (IDCT), and reproduces image data. By reverse processing of bit slice processing, bit-connecting processing returns the DCT multiplier for every divided bit to the original image.

[0010] If a compression image is transmitted through networks, such as N-ISDN, and elongation processing by progressive coding of SA method etc. is performed, the elongation image of high resolution will be obtained sequentially from the image of a low resolution.

[0011]

[Problem(s) to be Solved by the Invention] According to the image data retrieval by the elongation processing using progressive coding of JPEG through networks, such as N-ISDN which is the above-mentioned conventional technique, the contents of an image can be checked at the time of the low resolution picture display in early stages of transmission. However, there are not a function which stops transmission and elongation of an image on the way in the elongation processing by progressive coding of JPEG, and a function to rerun. For this reason, other actuation, for example, the following retrieval image, cannot be displayed, but there is a problem which requires time amount for image retrieval until transmission and elongation of an image are completed and it displays the image of final high resolution.

[0012]

[Means for Solving the Problem] There are the following approaches as a means to solve the above-mentioned technical problem. Two or more candidate images are transmitted through a network from the database which accumulates image data, and it displays on a terminal at two or more coincidence. A terminal performs elongation processing by progressive coding to the compressed transmission image. It is in the middle of an elongation display, and when unnecessary data are chosen, processing which displays the following retrieval candidate image for a display on a stop viewing area is performed. Moreover, it is in the middle of a display, and when the target data are checked, the elongation processing which displays only the processing which stops the display of other images, and a required image is continued. Furthermore, it attains by performing processing which

reruns a display to the image which suspended the display.

[0013] Specifically, the following approaches are used. The approach of a coincidence display of two or more retrieval images is performed by the processing which transmits two or more retrieval images from a database, and are displayed with a terminal unit. Moreover, in order to stop a display in the middle of the elongation processing by progressive coding, it carries out by preparing the transmission halt processing of the image data of a database, and the elongation halt processing of a terminal. Furthermore, in order to rerun a display, it carries out by preparing transmission rerun processing of the image data of a database, and elongation rerun processing of a terminal.

[0014]

[Function] The above-mentioned means acts as follows. That is, by performing transmission halt processing of the searched unnecessary image data, and transmission processing of the following image data in the middle of the elongation processing by progressive coding, transmissions of unnecessary image data are reducible, in an early transmission phase, the display of the following retrieval image is attained and retrieval time can be shortened. Moreover, since high-speed transmission of required image data can be performed and it becomes accelerable [the display of image data] by performing transmission halt processing of other image data when an image is chosen in the middle of the elongation processing by progressive coding, mitigation, retrieval time, and display time of a transmission load can be shortened. Furthermore, since rerun of the image data in the middle of a display can be performed and the high-speed return of the elongation processing by progressive coding is attained by performing transmission rerun processing of image data when elongation processing by progressive coding is rerun to the image which suspended the display, retrieval time can be shortened.

[0015]

[Example]

(Example 1) Drawing 2 is the block diagram of the earth environment observation ground information processing system which applied this invention.

[0016] An earth environment observation ground information processing system consists of the receiving system 202 which receives the image data sent from a satellite 201, the data processing system 203 which processes received data, and the database system 204 for preservation which carries out preservation management of the data and the analysis system 206 which analyzes data, and each system is connected by the networks 205, such as a Local Area Network.

[0017] The purpose of this system is that a user searches an image from the database system 204 for preservation through the networks 207, such as ISDN, from an analysis system 206.

[0018] Before describing the search method of this invention, the processing block diagram shown in drawing 1 explains the class and the recording approach of data which are accumulated in the database system for preservation.

[0019] The data stored in the database system 204 for preservation are an image and a browsing image as auxiliary information on image retrieval. These images are carried out compression processing 320, and it accumulates in an image file 321 and the browsing image file 322. A browsing image thins out a subject-copy image, is an image for retrieval which lessened the amount of data, and compresses it using the gradual compression approaches, such as progressive coding of JPEG. The compression approach of JPEG has the base-line compression which compresses the image other than compression by progressive coding collectively as the standard compression approach. The image accumulated in the database system 204 for preservation is compressed by the base-line compression approach of JPEG etc.

[0020] Next, the screen flow chart shown in the processing block diagram shown in drawing 1 and drawing 4 about an image search method explains.

[0021] In the retrieval condition input process 301, a user 325 inputs a sensor name, a photography date, and the retrieval conditions of lat/long using a keyboard 324. The retrieval condition screen 401 of the retrieval condition input process 301 consists of a sensor name 404 and a 405 lat/long photography date 406. For example, in the case of the image of TM sensor of Landsat, April 1, 1992, and the 135 north latitude 45-degree east longitudes, TM, 1992/4/1, and 45/135 are inputted as retrieval conditions.

[0022] The candidate image which corresponds to retrieval conditions from the browsing image file 322 using the browsing image retrieval table 501 shown in drawing 5 is searched with the browsing image directory management 302. The browsing image retrieval table 501 manages the number 505 and the file index 506 of the sensor name 502, the photography date 503, LAT LONG 504, and the browsing image file 322. For example, the file number of the browsing image which the 3rd column corresponds and corresponds when retrieval conditions are TMs — four, 1, 320, and 58,104, — it is . The browsing image directory management 302 transmits the candidate browsing image of the file number which corresponds from the browsing image file 322.

[0023] In the transmission processing 303, it transmits to an analysis system 206 to the browsing image which was seen as the candidate with the browsing image directory management 302. The browsing image to transmit is a compression image of progressive coding using the plane divided for every [by SA method] bit. In transmission processing, through N-ISDN, transmission is begun from the image of one plane and a low order plane is transmitted one by one. Moreover, when there are two or more candidate images by the browsing image directory management 302, in the transmission processing 303, it transmits by time-sharing processing which changes and performs transmission processing for every fixed time amount to four browsing images.

[0024] Elongation processing is carried out to the browsing image transmitted by the transmission processing 303. In the gradual elongation processing 304 by SA method of JPEG, loop-formation processing which repeats and processes a decryption, bit connecting, reverse quantization, and elongation processing of reverse DCT is performed to the plane divided for every bit. A detail is shown below.

[0025] In decryption processing, the entropy decryption of each plane transmitted using Huffman coding is carried out, and the DCT multiplier for every bit is outputted.

[0026] In bit-connecting processing, reverse processing of the bit slice processing performed by compression processing is performed, and joint processing of the plane for every bit is carried out. The DCT multiplier combined by joint processing is set to y0. The DCT multiplier y1 of the first plane is computed by the case (several 1) where the first plane is transmitted, and the DCT multiplier y0 combined by (several 6) is computed. For example, when 1 and b4 are 0, as for (b7, b6, b5, and b4), they are set to 1010, and as for y1, b7 of the first plane is set [0 and b5] to 10100000 by 1 and b6 by (several 1). y0 turns into 10100000 by (several 6). When the second plane is transmitted (several 2) (several 6), the first plane and the second plane are combined. When b3 of the second plane is 1, y2 is set to 1000 by (several 2), and y0 turns into 10101000 by (several 6). the following and (several 3) — and (several 4) (several 5) the original DCT multiplier is obtained by using and combining even the fifth plane.

[0027]

[Equation 1]

$$y1 = (b7 \cdot b6 \cdot b5 \cdot b4) \times 2^4 \cdots (\text{数}1)$$

[0028]

[Equation 2]

$$y_2 = (b_3) \times 2^3 \quad \dots \dots \dots (\text{数 } 2)$$

[0029]

[Equation 3]

$$y_3 = (b_2) \times 2^2 \quad \dots \dots \dots (\text{数 } 3)$$

[0030]

[Equation 4]

$$y_4 = (b_1) \times 2^1 \quad \dots \dots \dots (\text{数 } 4)$$

[0031]

[Equation 5]

$$y_5 = (b_0) \times 2^0 \quad \dots \dots \dots (\text{数 } 5)$$

[0032]

[Equation 6]

$$y_0 = \sum_{i=1}^5 y_i \quad \dots \dots \dots (\text{数 } 6)$$

[0033] Reverse quantization is performed using a quantization table with a value which is different for every frequency to the DCT multiplier of the frequency space combined by bit-connecting processing.

[0034] Reverse DCT processing is performed to the DCT multiplier of the reverse-quantized frequency space, and a subject-copy image is reproduced.

[0035] When there are two or more browsing images transmitted from the transmission processing 303, one gradual elongation processing is performed to one browsing image, and it performs by time-sharing processing which changes and performs gradual elongation processing for every fixed time amount.

[0036] In a display process 305, the browsing image obtained by the gradual elongation processing 304 is displayed on a screen. The retrieval screen 402 consists of browsing images 407-410, and displays four candidate browsing images at once.

[0037] In the selection processing 306, the target image is checked by viewing and an image is chosen from a display image by the click input using a mouse 326. For example, the browsing image 408 in the retrieval screen 402 is clicked.

[0038] When an image is chosen from the selection processing 306, gradual elongation of a browsing image is suspended. The elongation halt processing 307 performs interrupt processing made to interrupt loop-formation processing to the gradual elongation processing 304, and stops a decryption, bit connecting, reverse quantization, and the loop-formation processing that repeats each processing of reverse DCT and performs it. Moreover, when time-sharing processing which changes and performs gradual elongation processing for every fixed time amount to two or more browsing images is being performed, gradual elongation is suspended, applying interruption to each gradual elongation processing.

[0039] When an image is chosen by the selection processing 306, gradual transmission of a browsing image is suspended. The transmission halt processing 308 applies the interruption which interrupts processing to the transmission processing 303, and stops transmission of a browsing image. Transmission of the plane for every bit of the browsing image compressed by SA method by halt of the transmission processing 303 is suspended. When the transmission processing 303 is transmitting two or more images by time-sharing processing, transmission is suspended applying interruption to each transmission processing.

[0040] A browsing image to the image chosen by the selection processing 306 is searched. The image directory management 309 checks the image file number 602 using the image retrieval table 601 shown in drawing 6 from the table index 506 of the browsing image retrieval table 501, and the same table index 603. The image which is in agreement with the image file number 602 from an image file 321 is transmitted.

[0041] In the transmission processing 310, the image searched by the directory management 309 for images is transmitted to an analysis system 206 through a network. The browsing image to transmit is an image compressed using the base-line compression approach of JPEG etc.

[0042] The image transmitted by the transmission processing 311 is elongated by elongation processing. In elongation processing, each processing of a decryption, reverse quantization, and reverse DCT is performed, and the elongated image is obtained. The elongated image is saved at a file 323.

[0043] By display processing 312, the image saved at the file 323 is displayed as a detail image 411 of the detail screen 403.

[0044] By the above-mentioned processing, a browsing image can display and a detail image can be displayed.

[0045] In the above-mentioned example, it was the function which displays a detail image while displaying a browsing image. On the other hand, the function which displays the following candidate image instead of the display of a detail image is also realizable by the same processing as the above-mentioned example.

[0046] The case where transmission halt processing and elongation halt processing are performed is explained to the image chosen by selection processing with the processing block of drawing 7. The retrieval condition input 301 and the browsing image directory management 302 which are processing, and the transmission processing 303 in which the processing and the display which display a browsing image are suspended, the gradual elongation processing 304, display processing 305, the selection processing 306, the elongation halt processing 307, and the transmission halt processing 308 are the same processing as the above-mentioned example. Moreover, the transmission initialization processing 701 and the elongation initialization processing 702 which are processing for displaying the following candidate image differ from the above-mentioned example. The transmission initialization processing 701 which transmission suspends to the image chosen as below, and the elongation initialization processing 702 for performing a halt of gradual elongation and displaying the following browsing image are explained.

[0047] Initialization processing for transmitting the following candidate browsing image to the transmission processing 303 is performed. For example, when displaying the following candidate browsing image to the browsing image 408 on display on the retrieval screen 402, the transmission initialization processing 701 carries out the processing which cancels interruption to the transmission processing 303 under transmission halt, eliminates the image data of the browsing image 408 which it is in the middle of transmission, and sets up the following candidate browsing image. The following candidate browsing image is transmitted in the transmission processing 303.

[0048] Initialization processing for carrying out gradual elongation of the following candidate browsing image to the gradual elongation processing 304 is performed. When displaying the following browsing image to the browsing image 408 on display on

the retrieval screen 402, the elongation initialization processing 702 terminates a decryption, bit integration, reverse quantization, and loop-formation processing of reverse DCT to the gradual elongation processing 304 which has suspended elongation, and performs gradual elongation processing of the following candidate browsing image.

[0049] The following browsing image can be displayed by performing two above-mentioned processings.

[0050] Although this example explained the gradual compression elongation approach based on SA method of JPEG, it is realizable using SS or a hierarchie cull method of JPEG etc. Moreover, it is available to the search method of not only a browsing image but a detail image.

[0051] According to this example, by performing transmission halt processing and gradual elongation halt processing in the middle of the display of a browsing image, the display of a detail image or the display of the following candidate browsing image is attained in an early phase, and effectiveness is in compaction of image data retrieval time amount.

[0052] The example 1 was the image data retrieval approach which can suspend the display of a browsing image during the display of a browsing image. An example 2 shows the image data retrieval approach in which a halt and rerun of a display of a browsing image during the display of an image are possible.

[0053] (Example 2) The second example is shown in drawing 8. This example is the image data retrieval approach in which a halt and rerun of a display of a browsing image during the display of a browsing image are possible. The processing which suspends the processing and the display which display a browsing image is the same as that of an example 1. That is, the retrieval condition input 301 and the browsing image directory management 302 which are shown in drawing 8, the transmission processing 303, the gradual elongation processing 304, display processing 305, the selection processing 306, the elongation halt processing 307, and the transmission halt processing 308 are the same processings as an example 1. Moreover, the rerun selection processing 801 and the elongation rerun processing 802 which are processing for rerunning a display, and the transmission rerun processing 803 differ from an example 1. Below, the same processing as an example 1 is explained briefly.

[0054] Conditions when searching an image are inputted in the retrieval condition input 301.

[0055] The browsing image applicable to retrieval conditions is raised with the browsing image directory management 302 from the browsing image file 322 to a candidate.

[0056] In the transmission processing 303, a candidate browsing image is transmitted to a user analysis system.

[0057] Elongation processing is carried out to the browsing image transmitted by the gradual transmission processing 303. In the gradual elongation processing 304 by SA method of JPEG, loop-formation processing which repeats and processes a decryption, bit connecting, reverse quantization, and elongation processing of reverse DCT is performed.

[0058] In a display process 305, the browsing image obtained by the gradual elongation processing 304 is displayed on a screen.

[0059] In the selection processing 306, when the target image is checked by viewing from a display image, an image is chosen by the click input using a mouse 326. Hereafter, processing of an about is shown when an image is chosen.

[0060] In the elongation halt processing 307, the loop-formation processing of the gradual elongation processing 304 to the browsing image chosen using interrupt processing is stopped.

[0061] In the transmission halt processing 308, transmission of the plane for every bit of the transmission processing 303 to the browsing image chosen using interrupt processing is stopped.

[0062] By the same processing as the example 1 from the above processing 301 to processing 308, a halt of the display of a browsing image and a display is enabled.

[0063] The elongation halt processing 307 and transmission halt processing 308 are performed, and when selected transmission and elongation of a browsing image are suspended, transmission and elongation to a browsing image can be rerun again. Below, the detail of the rerun processing to the browsing image under halt is explained.

[0064] In the rerun selection processing 801, when carrying out regeneration of the browsing image under display halt, the image under halt is chosen by the click of a mouse 326. For example, when the browsing image 408 under display halt in the retrieval screen 402 is clicked, the elongation rerun processing 802 is as follows. That is, gradual elongation of a browsing image is rerun to the selected image. Interrupt processing cancels interruption to the gradual elongation processing 304 under halt, and gradual elongation processing is made to rerun by repeating each processing of a decryption, bit connecting, reverse quantization, and reverse DCT.

[0065] In the transmission rerun processing 803, gradual transmission of the browsing image which minded the network to the selected image is rerun. The transmission rerun processing 308 performs interruption discharge processing to the transmission processing 303. In the transmission processing 303, transmission of the lower bit of the browsing image compressed by interruption discharge processing by SA method is rerun.

[0066] The display of the browsing image under halt can be rerun by these rerun selection processing 801, the elongation rerun processing 802, and the transmission rerun processing 803.

[0067] Since according to this example high-speed transmission of a required browsing image can be performed in the middle of the display of a browsing image and it becomes it accelerable [the display of a browsing image] by performing transmission halt processing and gradual elongation halt processing, mitigation, retrieval time, and display time of a transmission load can be shortened. Since the high-speed return of a retrieval screen is furthermore attained according to this example when rerun of transmission processing and gradual elongation processing is performed to the browsing image which suspended the display, retrieval time can be shortened.

[0068]

[Effect of the Invention] According to this invention, it is in the middle of gradual elongation processing, a user can be operated, transmission processing and gradual elongation processing of image data can be suspended, and the display of a detail image, the display of the following candidate image, or the target image can be displayed on a high speed. An image can be viewed and checked by this, and the operate time which retrieval of an image takes is shortened, therefore a user's actuation load can be mitigated.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The flow chart of the bit slice which shows division of a DCT multiplier.

[Drawing 2] The block diagram of the earth environment observation ground information processing system which applied this invention.

[Drawing 3] The processing block diagram showing one example of the procedure of this invention.

[Drawing 4] The screen flow chart which shows the display screen of this invention.

[Drawing 5] The explanatory view of the browsing image retrieval table used for browsing image management of this invention.

[Drawing 6] The explanatory view of the image retrieval table used for image management of this invention.

[Drawing 7] The processing flow chart which shows attached processing of the procedure of drawing 3.

[Drawing 8] The processing flow chart which shows other examples of the procedure of this invention.

[Description of Notations]

301 [— Gradual elongation processing, 305 / — Display processing, 306 / — Selection processing, 307 / — Elongation halt processing, 308 / — Transmission halt processing, 320 / — Compression processing, 322 / — Browsing image file.] — Retrieval condition input process, 302 — Browsing image directory management, 303 — Transmission processing, 304

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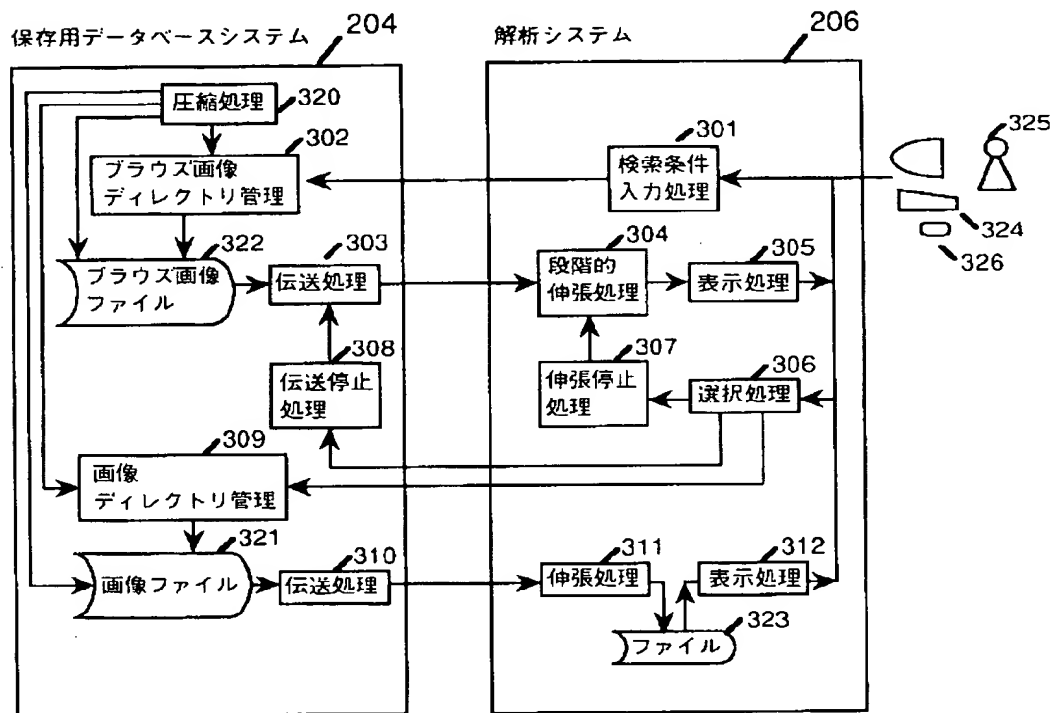
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DRAWINGS

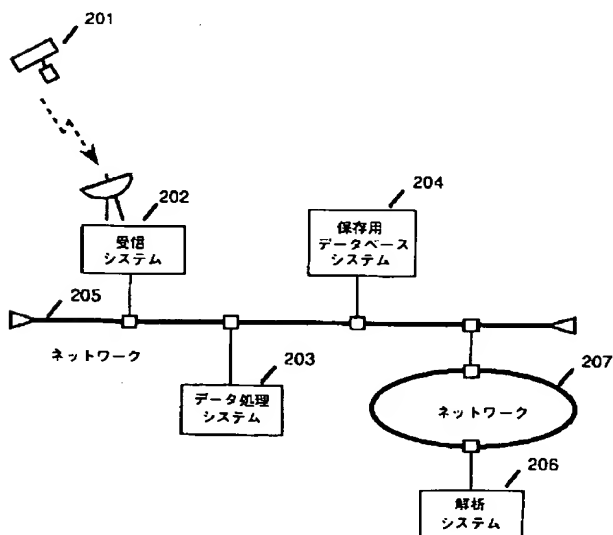
[Drawing 1]

図 1

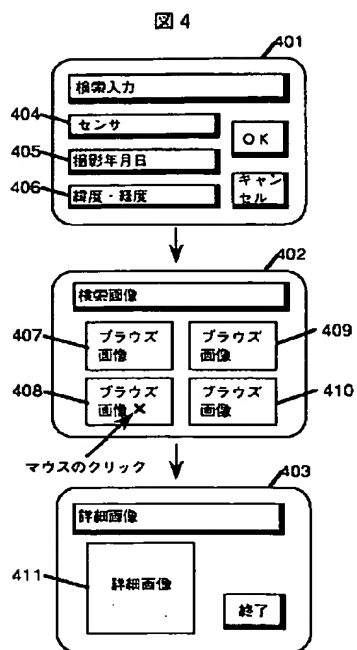


[Drawing 2]

図 2



[Drawing 4]

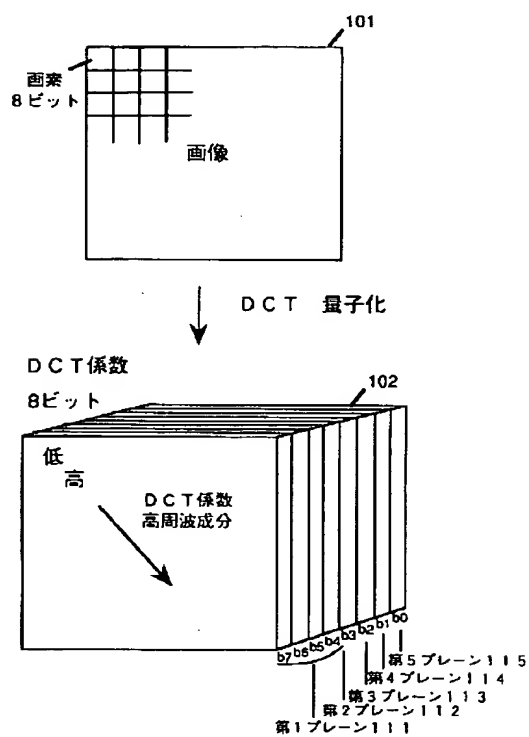


[Drawing 6]
図 6

画像テーブル インデックス	画像 ファイル番号
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2	512
3	1024
4	2048
5	196
6	768
7	386
.	.
.	.

[Drawing 3]

図 3



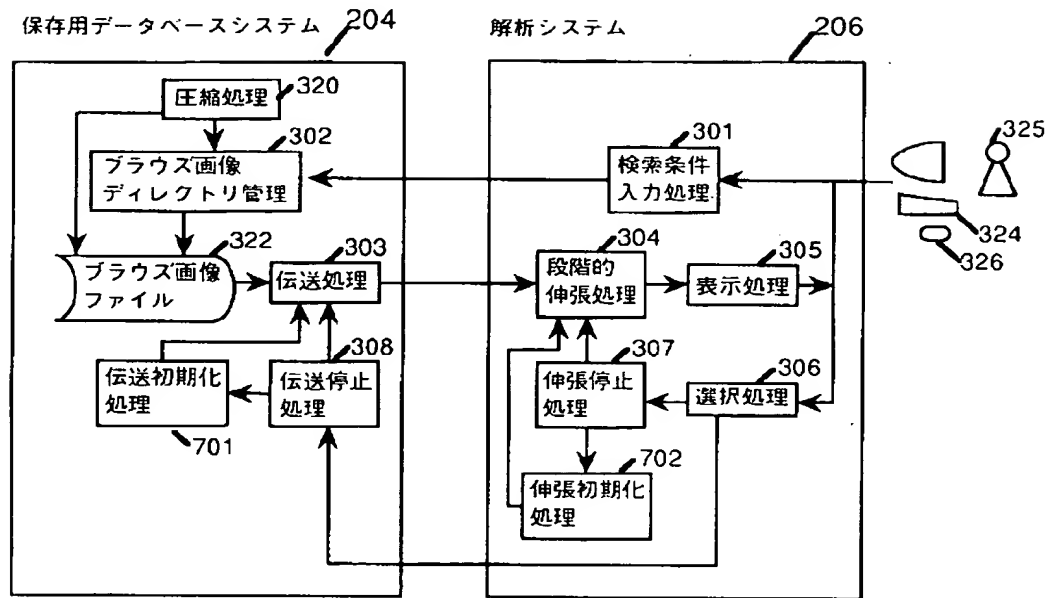
[Drawing 5]

図 5

502	503	504	505	506	
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SAR	1984 / 3 / 14	35 / 20	32	2	
TM	1985 / 4 / 5	40 / 135	1	3	
TM	1986 / 5 / 23	25 / 150	320	4	
TM	1987 / 6 / 30	50 / 120	58	5	
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ETM	1993 / 8 / 16	30 / 100	64	7	
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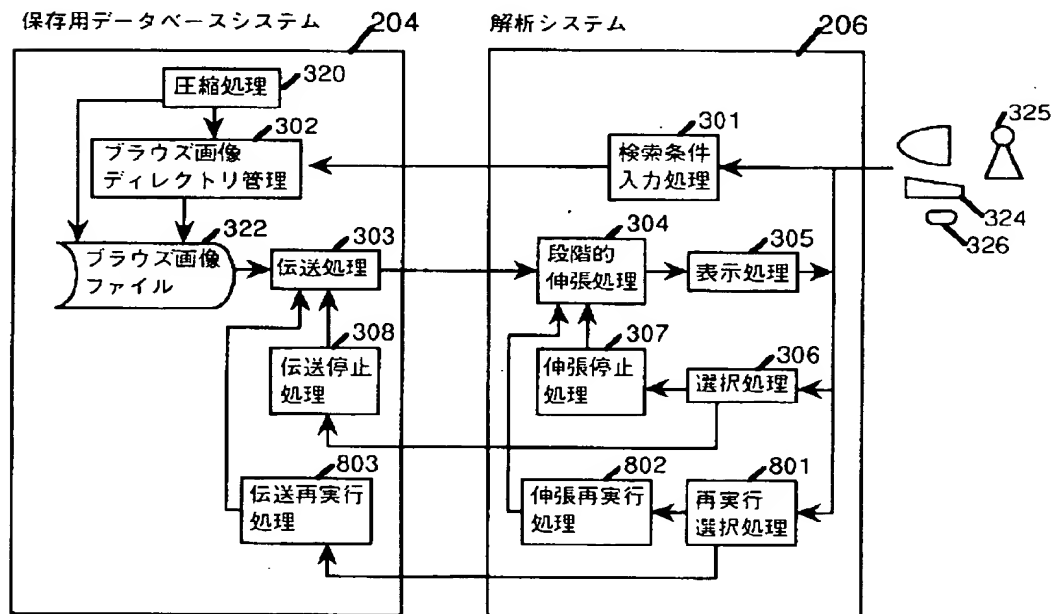
[Drawing 7]

図 7



[Drawing 8]

図 8



[Translation done.]

(IDCT) の各処理を繰り返して行っている間に、画像データを再生する。ビット結合処理はビットストライズ処理の逆の処理により、分離されたビット毎の DCT 係数を元の画像に反す。

【0010】 N-I SDN などのネットワークを介して圧縮画像を伝送し、SA 方式などのプログレッシブ符号化による伸張処理を行うと低解像度の画像が順に高解像度の伸張画像が得られる。

【0011】

【発明が解決しようとする課題】 上記従来技術である N-I SDN などのネットワークを介した J PEG のプログレッシブ符号化を用いた伸張処理による画像データ検索によれば、画像内容の検索を伝送初期の低解像度画像表示時に行うことができる。しかし、J PEG のプログレッシブ符号化による伸張処理では、画像の伝送および伸張を途中で止める機能と再実行する機能がない。このため、画像の伝送および伸張が終了し最終的な高解像度の画像を表示するまで、他の操作、例えば次の検索画像を表示することはできず、画像検索に時間がかかる問題がある。

【0012】

【課題を解決するための手段】 上記問題を解決する手段として以下の方策がある。画像データを蓄積するデータベースより複数の検索画像をネットワークを介して伝送し、例えば複数同時に表示する。例えば圧縮した伝送画像に対してプログレッシブ符号化による伸張処理を行う。伸張処理途中で不要なデータを選択した場合、表示を止め表示領域に次の検索画像を表示する処理を行う。また、表示途中で目的のデータを観望した場合、他の画像の表示を止める処理と必要画像のみ表示する伸張処理を継続する。さらに、表示を停止した画像に対し表示を再実行する処理を行うことにより達成する。

【0013】 具体的には、以下の方法を用いる。複数の検索画像の同時表示の方法は、データベースから複数の検索画像を伝送し検索装置で複数表示する処理にて行う。また、プログレッシブ符号化による伸張処理の途中で表示を止めるには、データベースの画像データの伝送停止処理と端末の伸張停止処理を併せて行う。さらに、表示を再実行するには、データベースの画像データの伝送再実行処理と端末の伸張再実行処理を併けることで行う。

【0014】

【作用】 上記手段は以下のように作用する。すなわち、プログレッシブ符号化による伸張処理の途中で、検索した不要な画像データの伝送停止処理および次の画像データの伝送処理を行うことで、不要な画像データの伝送が削減でき、初期の伝送段階で、次の検索画像の表示が可能となり、検索時間を短縮することができる。また、プログレッシブ符号化による伸張処理の途中で、画像の選択を行った場合、他の画像データの伝送停止処理を行う

ことで、必要な画像データの高速な伝送ができ、画像データの表示の高速化が可能となるため、伝送負荷の軽減、検索時間および表示時間を短縮することができる。さらに、表示を停止した画像に対してプログレッシブ符号化による伸張処理の再実行を行った場合、画像データの伝送再実行処理を行うことで、表示途中の画像データの再実行ができ、プログレッシブ符号化による伸張処理の高速化が可能となるため、検索時間を短縮することができ。

【0015】

【実施例】
〔発明例 1〕図 1 は本発明を適用した地球環境観測地上情報処理システムのブロック図である。

【0016】 地球環境観測地上情報処理システムは、第 201 から送られてくる画像データを受信する受信システム 202 と、受信データを処理するデータ処理システム 203 と、そのデータを保存管理する保存用データベースシステム 204 とデータを検索する解析システム 206 から成り、各々のシステムはローカルエリアネットワークなどのネットワーク 205 により接続される。

【0017】 本システムの目的は、利用者が、解析システム 206 より I SDN などのネットワーク 207 を介して、保存用データベースシステム 204 から画像を検索することである。

【0018】 本発明の検索方法を述べる前に、保存用のデータベースシステムに蓄積するデータの種類の蓄積方法について、図 1 に示す処理ブロック図により説明する。

【0019】 保存用データベースシステム 204 に蓄積するデータは、画像および画像検索の補助情報としてのブラウズ画像である。これらの画像を圧縮処理 320 し画像ファイル 321 とブラウズ画像ファイル 322 に蓄積する。ブラウズ画像は原画像を縮小し、データ量を少なくした検索用の画像であり、J PEG のプログレッシブ符号化などの段階的圧縮方法を用いて圧縮する。J PEG の圧縮方法にはプログレッシブ符号化による圧縮のほか、標準圧縮方法として画像を一括して圧縮するペーシング圧縮がある。保存用データベースシステム 204 に蓄積する画像は J PEG のペーシング圧縮方法などにより圧縮される。

【0020】 次に、画像検索方法について、図 1 に示す処理ブロック図と図 2 に示す画面フローチャートにより説明する。

【0021】 検索条件入力処理 301 では、利用者 325 が、キーボード 324 を用いてセンサ名、撮影年月日、緯度・経度の検索条件を入力する。検索条件入力処理 301 の検索条件画面 401 は、センサ名 404、撮影年月日 405、緯度・経度 406 からなる。例えば、検索条件としてランドサット衛星の TM センサ、1992 年 4 月 1 日、北緯 45 度東経 135 度の画像の場合には T

伸張処理 304 では、ビット毎に分離したプレーンに対し、復号化、ビット結合、逆量子化、逆 DCT の伸張処理を繰り返して処理するループ処理を行う。詳細を以下に示す。

【0025】 復号化処理では、ハフマン符号を用いて伝送される各プレーンをエン트로ピ復号化し、ビット毎の DCT 係数出力する。

【0026】 ビット結合処理では、圧縮処理で行うビットストライズ処理の逆処理を行い、ビット毎のプレーンを結合処理する。結合処理により結合される DCT 係数を y0 とする。第一プレーンが伝送された場合 (数 1) により第一プレーンの DCT 係数 y1 を算出し、(数 6) により結合される DCT 係数 y0 を算出する。例えば、第一プレーンの b7 が 1、b6 が 0、b5 が 1、b4 が 0 の場合、(b7・b6・b5・b4) は 1010 となり、y1 は (数 1) により 10100000 となる。y0 は (数 6) により 10100000 となる。第二プレーンが伝送された場合 (数 2) および (数 6) により、第一プレーンと第二プレーンを結合する。第二プレーンの b3 が 1 の場合、y2 は (数 2) により 1000 となり、y0 は (数 6) により 10101000 となる。以下、(数 3) と (数 4) および (数 5) を用いて第五プレーンまでを結合することにより、元の DCT 係数が得られる。

【0027】

【数 1】

$$y1 = (b7 \cdot b6 \cdot b5 \cdot b4) \cdot x2^7 \cdots (数 1)$$

【数 2】

$$y2 = (b3) \cdot x2^1 \cdots (数 2)$$

【数 3】

$$y3 = (b2) \cdot x2^2 \cdots (数 3)$$

【数 4】

$$y4 = (b1) \cdot x2^1 \cdots (数 4)$$

【数 5】

$$y5 = (b0) \cdot x2^0 \cdots (数 5)$$

【数 6】

$$y0 = \sum_{i=1}^5 y_i \cdots (数 6)$$

像が増加した場合、一つのブラウズ画像に対して一つの段階的伸張処理を行い一定の時間ごとに段階的伸張処理を切り替えて実行する時分割処理により実行する。

【0036】 表示処理 305 では、段階的伸張処理 304 により得られたブラウズ画像を画面上に表示する。検索画面 402 は、ブラウズ画像 407 から 410 よりな

り、一度に四つの候補ブラウズ画像を表示する。

【0037】選択処理306では、表示画像から目的の画像を目視により選択し、マウス326を用いたクリック入力により画像を選択する。例えば、検索画面402におけるブラウズ画像408をクリックする。

【0038】選択処理306より画像が選択された場合、ブラウズ画像の段階的伸張処理を停止する。伸張停止処理307は段階的伸張処理304に対しループ処理を中断させる割込み処理を行い、復号化、ビット結合、逆量子化、逆DCTの各処理を繰り返して行うループ処理を停止させる。また、複数のブラウズ画像に対して一定時間ごとに段階的伸張処理を切り替えて実行する分割処理を行っていた場合、各々の段階的伸張処理に割込みをかけて段階的伸張を停止する。

【0039】選択処理306により画像が選択された場合、ブラウズ画像の段階的伝送を停止する。伝送停止処理308は伝送処理303に対して処理を中断させる割込みをかけてブラウズ画像の伝送を停止させる。伝送処理303の停止によりSA方式で圧縮したブラウズ画像のビット毎のプレーンの伝送を停止する。伝送処理303が複数の画像を分割処理により伝送していた場合には、各々の伝送処理に割込みをかけて伝送を停止する。

【0040】選択処理306により選択されたブラウズ画像から画像の検索を行う。画像レクタリ管理309は図1に示す検索テーブル001を用い、ブラウズ画像検索テーブル501のテーブルインデックス506と同様テーブルインデックス603から画像ファイル番号602を照準する。画像ファイル321から画像ファイル番号602に一致する画像を伝送する。

【0041】伝送処理310では画像用ディクトリ管理309により検索した画像をネットワークを介して解析システム206に伝送する。伝送するブラウズ画像は、JPEGのベースライン圧縮方法などを用いて圧縮した画像である。

【0042】伝送処理311により伝送された画像を伸張処理により伸張する。伸張処理では復号化、逆量子化、逆DCTの各処理を行い、伸張した画像を作る。伸張した画像をファイル323に保存する。

【0043】ファイル323に保存した画像を表示処理312により、詳細画面403の詳細画像411として表示する。

【0044】上記の処理により、ブラウズ画像の表示で詳細画像の表示を行うことができる。

【0045】上記実施例ではブラウズ画像の表示中に、詳細画像の表示を行う機能であった。これに対し詳細画像の表示のかわりに次の候補画像の表示を行う機能も上記実施例と同様の処理にて実現できる。

【0046】図1の処理ブロックにより選択処理により選択された画像に対して、伝送停止処理と伸張停止処理を実行した場合について説明する。ブラウズ画像を表示

する処理および表示を停止する処理である検索条件入力301とブラウズ画像ディレクトリ管理302と伝送処理303と段階的伸張処理304と表示処理305と選択処理306と伸張停止処理307と伝送停止処理308は上記実施例と同様の処理である。また、次の候補画像を表示するための処理である伝送初期化処理701および伸張初期化処理702が上記実施例と異なる。以下に、選択した画像に対して伝送の停止する伝送初期化処理701と、段階的伸張の停止を実行し次のブラウズ画像を表示するための伸張初期化処理702を説明する。

【0047】伝送処理303に対して次の候補ブラウズ画像を伝送するための初期化処理を行う。例えば、検索画面402に表示中のブラウズ画像408に対して次の候補ブラウズ画像を表示させる場合、伝送初期化処理701は、伝送停止中の伝送処理303に対して割込みを解除し伝送の途中であるブラウズ画像408の画像データを消去して次の候補ブラウズ画像を設定する処理を行う。伝送処理303では次の候補ブラウズ画像を伝送する。

【0048】段階的伸張処理304に対して次の候補ブラウズ画像を段階的伸張するための初期化処理を行う。検索画面402に表示中のブラウズ画像408に対して次のブラウズ画像を表示させる場合、伸張初期化処理702は、伸張を停止して次の段階的伸張処理304に対して復号化、ビット結合、逆量子化、逆DCTの各処理を終了させ、次の候補ブラウズ画像の段階的伸張処理を実行する。

【0049】上記の二つの処理を行うことにより、次のブラウズ画像を表示することができる。

【0050】本実施例は段階的伸張伸張処理方法について、JPEGのSA方式をベースに説明したが、JPEGのSS方式またはハイアラキカル方式などを用いて実現することができる。また、ブラウズ画像のみならず詳細画像の検索方法に利用可能である。

【0051】この実施例によれば、ブラウズ画像の表示途中に、伝送停止処理および段階的伸張停止処理を行うことで、早い段階で詳細画像の表示または次の候補ブラウズ画像の表示が可能となり、画像データ検索時間の短縮に効果がある。

【0052】実施例1は、ブラウズ画像の表示中にブラウズ画像の表示の停止が可能な画像データ検索方法であった。実施例2は、画像の表示中にブラウズ画像の表示の停止および再実行が可能な画像データ検索方法を示す。

【0053】(実施例2) 第二の実施例を図2に示す。本実施例はブラウズ画像の表示中にブラウズ画像の表示の停止および再実行が可能な画像データ検索方法である。ブラウズ画像を表示する処理および表示を停止する処理は実施例1と同様である。すなわち、図2に示す検索条件入力301とブラウズ画像ディレクトリ管理30

2と伝送処理303と段階的伸張処理304と表示処理305と選択処理306と伸張停止処理307と伝送停止処理308は上記実施例1と同様の処理である。また、表示を再実行するための処理である再実行選択処理801と伸張再実行処理802と伝送再実行処理803が実施例1と異なる。以下に、実施例1と同様の処理を簡単に説明する。

【0054】検索条件入力301では、画像を検索する上で条件を入力する。

【0055】ブラウズ画像ディレクトリ管理302ではブラウズ画像ファイル322から検索条件に該当するブラウズ画像を検索しあげる。

【0056】伝送処理303では候補ブラウズ画像をユーザ解析システムに伝送する。

【0057】段階的伝送処理303により伝送されたブラウズ画像に対し伸張処理をする。JPEGのSA方式による段階的伸張処理304では、復号化、ビット結合、逆量子化、逆DCTの伸張処理を繰り返して処理するループ処理を行う。

【0058】表示処理305では、段階的伸張処理304により得られたブラウズ画像を画面上に表示する。

【0059】選択処理306では、表示画像から目的の画像を目視により選択した場合、マウス326を用いたクリック入力により画像を選択する。以下、画像が選択された場合についての処理を説明する。

【0060】伸張停止処理307では、割込み処理を用いて選択されたブラウズ画像に対する段階的伸張処理304のループ処理を停止させる。

【0061】伝送停止処理308では、割込み処理を用いて選択されたブラウズ画像に対する伝送処理303のビット毎のプレーンの伝送を停止させる。

【0062】以上の処理301から処理308までの実施例1と同様の処理により、ブラウズ画像の表示および表示の停止が可能とする。

【0063】伸張停止処理307と伝送停止処理308を実行し、選択したブラウズ画像の伝送および伸張を停止した場合、再度、ブラウズ画像に対する伝送と伸張を再実行することができる。以下に、停止中のブラウズ画像に対する再実行処理の詳細について説明する。

【0064】再実行選択処理801では、表示停止中のブラウズ画像を再表示する場合、マウス326のクリックにより停止中の画像を選択する。例えば、検索画面402における表示停止中のブラウズ画像408をクリックした場合、伸張再実行処理802は以下のようになる。すなわち、選択した画像に対してブラウズ画像の段階的伸張を再実行する。割込み処理により停止中の段階的伸張処理304に対し割込みを解除し、復号化、ビット結合、逆量子化、逆DCTの各処理を繰り返して再度、段階的伸張処理を再実行させる。

【0065】伝送再実行処理803では、選択した画像に対してネットワークを介したブラウズ画像の段階的伝送を再実行する。伝送再実行処理308は伝送処理303に対して割込み解除処理を行う。伝送処理303では割込み解除処理によりSA方式で圧縮されたブラウズ画像の下位ビットの伝送が再実行される。

【0066】これら再実行選択処理801と伸張再実行処理802と伝送再実行処理803により、停止中のブラウズ画像の表示を再実行することができる。

【0067】本実施例によれば、ブラウズ画像の表示途中に、伝送停止処理および段階的伸張停止処理を行うことで、必要なブラウズ画像の高速伝送ができ、ブラウズ画像の表示の高速化が可能となるため、伝送負荷の軽減、検索時間および伸張時間を短縮することができる。さらにこの実施例によれば、表示を停止したブラウズ画像に対して伝送処理および段階的伸張処理の再実行を行った場合、検索画面の高速復帰が可能となるため、検索時間を短縮することができる。

【0068】

【発明の効果】本発明によれば、段階的伸張処理途中で利用者の操作が行え、画像データの伝送処理および段階的伸張処理を停止し、詳細画像の表示あるいは次の候補画像の表示あるいは目的の画像を割込みで表示することができ、これにより画像を目視し確認でき、画像の検索に要する操作時間を短縮し、従って利用者の操作負荷が軽減できる。

【図面の簡単な説明】

【図1】DCT係数の分解を示すビットストライムのフローチャート。

【図2】本発明を適用した地球環境観測地上情報処理システムのブロック図。

【図3】本発明の処理手順の一枚画像を示す処理ブロック図。

【図4】本発明の表示画面を示す画面フローチャート。

【図5】本発明のブラウズ画像管理に用いるブラウズ画像検索テーブルの説明図。

【図6】本発明の画像管理に用いる画像検索テーブルの説明図。

【図7】図3の処理手順の付加処理を示す処理フローチャート。

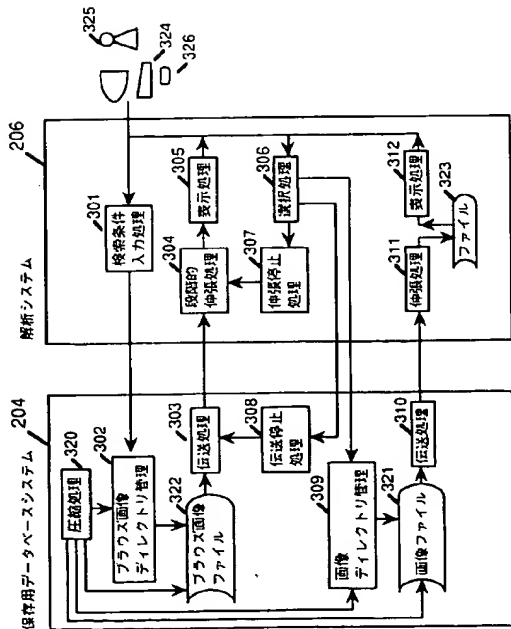
【図8】本発明の処理手順の他の実施例を示す処理フローチャート。

【符号の説明】

301…検索条件入力処理、302…ブラウズ画像ディレクトリ管理、303…伝送処理、304…段階的伸張処理、305…表示処理、306…選択処理、307…伸張停止処理、308…伝送停止処理、320…圧縮処理、322…ブラウズ画像ファイル。

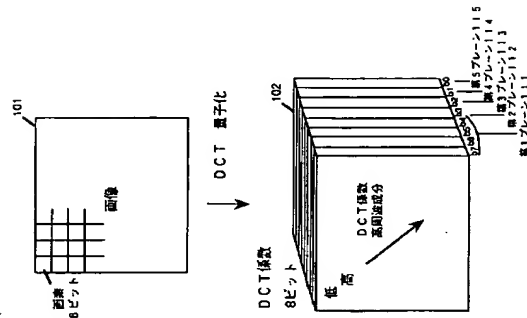
【図1】

図1



【図3】

図3



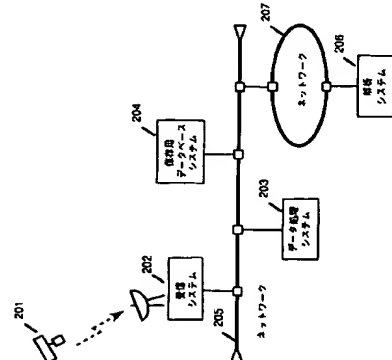
【図5】

図5

502	503	504	505	506
センサ名	撮影年月日	ファイル番号	画像データ形式	画像データ形式
OCT	1995/1/3	40/120	256	1
SAR	1995/3/14	35/20	32	2
TM	1995/4/15	40/135	1	3
TM	1996/5/22	25/150	320	4
TM	1997/6/20	50/120	54	5
TM	1998/4/1	45/135	104	6
ETM	1993/8/16	20/100	64	7
...

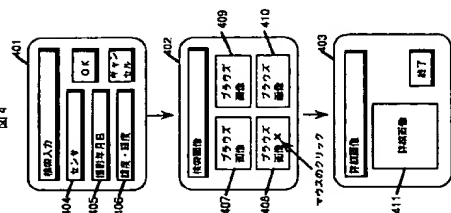
【図2】

図2



【図4】

図4



【図6】

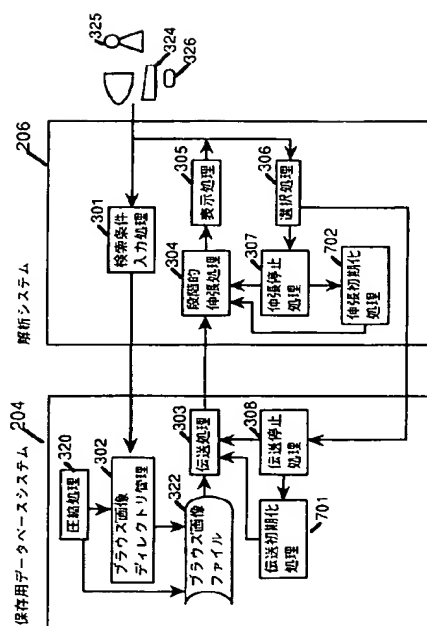
図6

503	502
画像データ形式	画像データ形式
1	128
2	512
3	1024
4	2048
5	196
6	768
7	384
...	...

フロントページの続き

【図 7】

図 7



【図 8】

図 8

